

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
  - TEXT CUT OFF AT TOP, BOTTOM OR SIDES
  - FADED TEXT
  - ILLEGIBLE TEXT
  - SKEWED/SLANTED IMAGES
  - COLORED PHOTOS
  - BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- 
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

---

**THIS PAGE BLANK (USPTO)**

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets

(11) Publication number:

**0 384 383**  
**A2**

(12)

# EUROPEAN PATENT APPLICATION

(21) Application number: 90103213.6

(51) Int. Cl.<sup>5</sup>: A63C 17/04, A63C 5/035

(22) Date of filing: 20.02.90

(30) Priority: 20.02.89 JP 39719/89

15.05.89 JP 120838/89

19.06.89 JP 156138/89

23.08.89 JP 216270/89

25.08.89 JP 219598/89

23.10.89 JP 275362/89

(43) Date of publication of application:  
29.08.90 Bulletin 90/35(64) Designated Contracting States:  
CH DE ES FR GB IT LI NL SE(71) Applicant: Nagahisa, Kouichi  
2-37, Ekinan 4-chome  
Takaoka-shi, Toyama-ken 933(JP)(72) Inventor: Nagahisa, Kouichi  
2-37, Ekinan 4-chome  
Takaoka-shi, Toyama-ken 933(JP)(74) Representative: Goddar, Heinz J., Dr. et al  
FORRESTER & BOEHMERT  
Widenmayerstrasse 4/I  
D-8000 München 22(DE)

(54) Sliding device.

(57) There are disclosed several sliding devices. One sliding device comprises a sheet (S) mounted on a slope (1) and having a descending substrate (2), a plurality of recesses (5) arranged uniformly on the substrate (2), a plurality of balls (4) engaged in the recesses (5) for supporting the ski and rotatable in

full directions, the plurality of balls (4) being exposed over the substrate (2) so that the ski contact the balls (4), and projecting edges (12) provided at peripheries of the recesses (5) on the substrate (2) for preventing the plurality of balls (4) from getting out from the recesses (5).

EP 0 384 383 A2

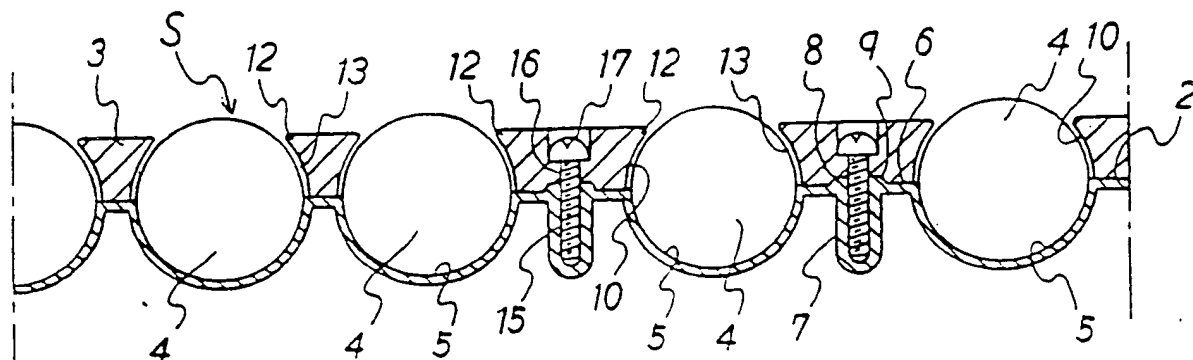


FIG 3

## SLIDING DEVICE

The present invention relates to a sliding device, more particularly to the sliding device such as an artificial ski slope for ski descending practice, and those mounted on the ski, sleigh, skate board.

In the case an artificial snow is used in the artificial ski slope, it costs much for producing the artificial snow and installing air conditioners so that the artificial ski slope having an artificial lawn thereon (hereinafter referred to as artificial lawn ski slope) has become a main current for ski descending practice.

The artificial lawn ski slope comprises an artificial lawn layed on the slope. A descending sheet (mounted on the slope (hereinafter referred to as sheet) has the artificial lawn made of flexible or rigid plastic fiber implanted thereon. The people (hereinafter referred to as player) can ski smoothly on the artificial lawn ski slope since the slide and the cushion necessary for descending is obtained between the artificial lawn ski slope and a pair of skis (hereinafter simply referred to as ski).

A sliding surface of a prior art sliding device of the ski is formed flat so as to slide on the snow slope or the artificial ski slope provided with a direction restricting groove along the center of the width direction thereof. A prior art sleigh is generally provided with the sliding surface of the same structure set forth above. Prior art skate boards (hereinafter referred to as simply skate board) have rollers corresponding to the wheels, which are supported by the shafts provided at the bottom surface thereof so as to rotate forward and backward.

The prior art sliding device formed of conduit shape typically comprises an inclined flat bottom plate, and side plates or frames protruded from the bottom plate at both sides thereof. The player sits on the sliding device and grips the side frames while sliding on the slope.

There has been proposed the sliding device comprising the bottom plate having a plurality of rollers uniformly arranged thereon. This sliding device utilizes a sliding friction generated between the rollers and the slope. The rollers are supported, like beads on an abacus, by a plurality of shafts arranged laterally on the bottom plate or accommodated in a plurality of recessed holes provided at the bottom plate thereof.

However, there are following problems in the prior art sliding device.

In the case of the prior art artificial ski slope, firstly, inasmuch as the ski slides against a sliding friction between the ski and the lawn there produces unneglected high frictional heat for thereby melting the lawn whereby the melted lawn is attached to the ski. Accordingly, the artificial lawn is

soon damaged at the place where frequent descending practice is made, hence the lawn is replaced by the new one. Due to melting of the artificial lawn, the descending speed is restrained, differing from on the natural snow slope so that the desired speed can not be obtained.

Secondly, inasmuch as the artificial lawn is liable to reduce the descending speed, the artificial ski slope is sharply inclined to obtain high descending speed which involved the damage of the artificial lawn, although the natural snow slope is melted at its surface with thin thickness and the friction between the ski and the thin melted snow slope is very slight so that the player can descend on the natural snow slope at high speed.

In the case of the prior art ski or the sleigh, the player can not slide on the ski without the natural snow or in the natural ski slope it costs much for installing the facilities since the plastic fiber is implanted on the sliding sheet and the thus implanted sliding sheet is weared or melted by the frictional heat generated between the ski and the sliding sheet. Hence, the sleigh and the sliding sheet involved less durability, high cost for maintenance thereof.

On the other hand, in the case of the prior art skate board, if the rollers are simply supported by the shafts, the player feels inferior cushion which allows the player uncomfortable. When the shafts supporting the rollers are urged by springs for obtaining better cushion, the structure is complicated, and the player is liable to be involved in accidents and feels unbalanced and unstable.

In the case of the sliding device having a flat bottom plate, the hip is heated during descending action due to the frictional heat and the desired speed can not be obtained because of the frictional heat except that the slope is sharply inclined. If the slope is shaply inclined, the danger is increased during the descending action which involves the difficult assurance of safety.

In the case of the prior art sliding device having the rollers provided at the bottom plate (hereinafter referred to as roller type), a considerable high speed can be obtained even on the gentle slope, which assures the safety but there is a likelihood of danger that the rollers are caught in the parts of the wear. Furthermore, since the hip strikes strong against the corner of the roller which permits the player to feel pain at their hips, hence there is a problem that the comfortable descending can not be obtained. Still furthermore, the roller type is difficult to take such a structure that the descending surface on the slope is curved relative to the width direction of the slope and the both

sides of the slope are gradually elevated. Hence, in the roller type, both sides of the slope are elevated stepwise in the unnatural manner.

More still furthermore, in the roller type, the guiding direction due to the rotation of the roller is restricted by the rotary direction for thereby make the turn difficult. Hence, the design of the curved and variable course is restricted. Even if the slide is so designed that the player can readily turn on the slope with his own intention, and the slope is wider like the ski slope, it is difficult to turn the sliding direction without applying the force to the rollers with might and main. There is a danger of falling down on the slope if the player applies the force on the slide with might and main.

The present invention has been made in view of the problems set forth above.

That is, the inventor carried out various experiments and discovered that rolling friction is generated at the sliding of ski if a plurality of balls are rotatably held on the slope which is extremely similar to the natural snow slope.

It is an object of the present invention to provide an artificial ski slope, on which the player can descend, utilizing rolling friction without generating frictional heat whereby desired slalom and descending speed can be obtained like a natural ski slope.

The other objects are same as the advantages set forth in the following description. Hence, the explanation thereof is omitted.

To achieve the above objects of the present invention, the sliding device comprises a sheet mounted on a slope and having a descending substrate, a plurality of recesses arranged uniformly on the substrate, a plurality of balls engaged in the recesses for supporting the ski and rotatable in full directions, the plurality of balls being exposed over the substrate so that the ski contact the balls, and projecting edges provided at peripheries of the recesses on the substrate for preventing the plurality of balls from getting out from the recesses.

The above and other objects, features and advantages of the present invention will become more apparent from the following description taken in conjunction with the accompanying drawings.

Fig. 1 is a perspective view of a sliding device according to a first embodiment of the present invention;

Fig. 2 is a partly cut out plan view showing a descending sheet employed in the first embodiment;

Fig. 3 is an enlarged cross section taken along A-A of Fig. 2;

Fig. 4 is a partly cut out plan view showing a descending sheet employed in a second embodiment;

Fig. 5 is an enlarged cross section taken

along B-B of Fig. 4;

Fig. 6 is a partly cut out plan view showing a descending sheet employed in a third embodiment;

Fig. 7 is an enlarged cross section taken along C-C of Fig. 6;

Figs. 8 to 10 are views of assistance in explaining structures and arrangements of the balls having large, middle, small diameters respectively employed in the third embodiment;

Fig. 11 is a partly cut out plan view showing a descending sheet employed in a fourth embodiment;

Fig. 12 is an enlarged cross section taken along D-D of Fig. 11;

Figs. 13 and 14 are views of assistance of explaining structures and arrangements of the balls having large, middle diameters respectively employed in the fourth embodiment;

Fig. 15 is a perspective view of a ski as a sliding device according to a fifth embodiment of the present invention;

Fig. 16 is a partly cut out plan view showing a descending sheet employed in the fifth embodiment;

Fig. 17 is an enlarged cross section taken along E-E of Fig. 16;

Fig. 18 is a perspective view of a sliding device according to a sixth embodiment of the present invention;

Fig. 19 is a view of assistance in explaining structures and arrangements of free balls and restricting balls respectively employed in the sixth embodiment;

Fig. 20 is an enlarged cross section taken along F-F of Fig. 19; and

Fig. 21 is an enlarged cross section taken along G-G of Fig. 19.

#### 40 First Embodiment (Figs. 1 to 3):

An artificial ski slope as the sliding device according to a first embodiment of the present invention will be described with reference to Figs. 1 to 3.

The artificial ski slope located outdoor utilizes the slopes in mountains, hills and parks which are defined as a slope 1. The slope 1 can be formed by a frame. A sheet S is layed on the slope 1. The sheet S comprises a substrate 2, a presser plate 3 and a plurality of balls 4. The substrate 2 is made of rigid plastics and has a plurality of recesses 5, 5 ... defined thereon by recessing thereof hemispherically at an angle of 45°. Inasmuch as the substrate 2 has wide planes 6 surrounded by the plurality of recesses 5, 5 ..., internal threads 7 are provided at the central portions of the wide planes 6 and the internal threads 7 are projected down-

ward. Tenons 8 are formed projected from the wide planes 6 at the peripheries of the internal threads 8.

The presser plate 3 each having a large thickness is made of a synthetic rubber and ejecting holes 10 having a diameter slightly greater than the diameter of the balls 4 at the portion corresponding to each recess 5 on the substrate 1. Projecting edges 12 are provided at the peripheries of the opening of the recesses 5 on the substrate 1 so as to narrow the opening of the recesses 5. Projecting edges 12 are formed along the imaginary spherical balls, namely, the inner surfaces of each ejecting hole 10 is joined with the imaginary spherical balls. Inasmuch as the imaginary spherical balls are formed greater than the balls 4, clearances 13 are defined between the inner surfaces of the ejecting holes and the outer surfaces of the balls 4. Provided on the presser plate 3 at the portions corresponding to the internal threads 7 are holes 16 through which small screws 15 are screwed. There are defined houses 17 at the upper ends of the holes 16 to accommodate the screw heads of the small screws. The presser plates 3 have mortises 9 at the lower portions thereof around the peripheries of the holes 16 for engaging with the tenons 8.

Although the presser plates 3 are fastened to the upper surfaces of the substrate 2 by the small screws 15, but the presser plates 3 are accurately positioned by the engagement between the tenons 8 and the mortises 9 and the clearances 13 between the balls 4 and the ejecting holes 10 are kept constant.

Since the screw heads of the small screws 15 are appeared from the upper portion thereof after completion of the assembly of the presser plates 3 and the balls 4 on the substrate 2, it is desirable to introduce an adhesive resin liquid into the houses 17 and seal the screw heads in the houses 17 so that the screw heads can not be viewed.

The balls 4 are made of compound vulcanized rubber mixed with carbon black for eliminating static electricity. The balls 4 are formed spherically substantially same as the recesses 5 so as to contact the inner surfaces of the recesses 5. A part of each ball 4 is projected from the upper surface of each presser plate 3.

When the assembled sheet S is layed on the slope 1, the assembled sheet S is merely placed on the upper surface of the slope after the slope is levelled. The assembled sheet S can not be slipped down along the inclination of the slope, even if it is merely placed on the slope 1, since the uneven portions such as recesses 5 and the internal threads 7 bite into the slope 1.

When the player makes the ski descending practice on the artificial ski slope having such arrangement set forth above, the thrust toward the

inclination direction caused by the gravity is transmitted from the ski to the balls 4 for thereby rotating the balls 4 whereby the player can descend.

Although the most parts of the balls 4 are housed in the recesses 5, the balls 4 are rotatable with ease in the recesses 4 because of the clearances 13 and the friction is not generated between the ski and the balls 4 whereby the balls 4 do not resist against the thrust of the ski. Hence, it is possible to descend at high speed. Furthermore, no frictional heat is generated between the ski and the balls 4 since there is generated rolling friction therebetween.

#### Second Embodiment (Figs. 4 and 5):

The sliding device according to a second embodiment will be described with reference to Figs. 4 and 5.

The substrate 202 is made of rigid plastics and is recessed hemispherically to form recesses 206, 207 in which large and small balls 204, 205 are rotatably engaged. The recesses 206 in which the large balls 204 are engaged are arranged in the direction of 45° and the recesses 207 in which the small balls 205 are engaged are arranged in the middle of the portion positioned over and lower, right and left of the recesses 206.

Each recess 206 has a receiving portion 209 on which each large ball 204 is placed. Clearance 210 is defined between the inner surface of the recess 206 and the large ball 204. The receiving portion 209 has a very small recess 209a in which the part of each large ball 204 is engaged and each large ball 204 is rotatable about the part thereof engaged in the recess 209a. Hence, the frictional resistance generated at the time of rotation of each large ball 204 is very small so that the inner surface of each recess 206 serves as the guide of each large ball 204. Accordingly, each large ball 204 smoothly rotates in each recess 206.

On the other hand, each small ball 205 is rotatably engaged in each recess 207 so as to be brought into contact with the inner surface of each recess 207 so that the relatively greater frictional resistance is generated between each small ball 205 and the inner surface of each recess 207.

The presser plate 203 made of semi-rigid synthetic rubber and formed in large thickness has ejecting holes 211, 212 corresponding to the recesses 206, 207 in the manner that the ejecting holes 211, 212 are formed along the imaginary ball, namely, the inner surfaces of each ejecting hole 211, 212 is joined with the imaginary ball. Hence, the ejecting holes 211, 212 are defined to narrow the opening diameters of the recesses 206, 207.

However, the imaginary balls along which the ejecting holes 211, 212 are formed are defined to be larger than the large and the small balls 204, 205, there are defined clearances 214, 215 between the inner surfaces of the ejecting holes 211, 212 and the large and the small balls 204, 205.

### Third Embodiment (Figs. 6 to 10):

The sliding device according to a third embodiment will be described with reference to Figs. 6 to 10.

The substrate 302 is provided with a plurality of recesses 306, 306a, 307 in which large, middle, small balls 304, 304a, 305 are rotatably engaged. The recesses 306, 306a are regularly arranged at the angle of  $45^\circ$  and the recess 307 are arranged over and left, right and left of the recesses 306, 306a at the middle portion between the recesses 306, 306a. Hence, the recess 307 is also regularly arranged at the angle of  $45^\circ$ . The arrangement of the large and the middle balls 304, 304a are illustrated in Fig. 6 in the manner that the middle balls 304a are arranged aslant at the angle of  $45^\circ$  and vertically and laterally alternately.

The middle balls 304a made of semi-rigid plastics have a relatively greater rotational frictional resistance caused between the inner surfaces of the recesses 306a and the middle balls 304a, hence the rotation thereof is restricted than that of the large balls 304. The recesses 307 with which the small balls 305 are brought into contact and rotatably engaged in have also relatively greater rotational frictional resistance, hence the rotation thereof is also restricted.

The relation between the large, the middle, the small balls are described more in detail.

The height of the large balls 304 exposed from the substrate 302 are higher than those of the middle balls 304a, and that of the middle balls 304a are higher than that of the small balls 305. As far as the player makes a schussing ski the ski slides only on the large balls 304 having the least frictional resistance for thereby descending at high speed. When the schussing is turned to the traversing, the ski slides on the middle and the small balls 304a, 305 having respectively greater resistance for thereby reducing the sliding speed whereby the turn can be made with ease like on the natural snow slope. In making the traversing, the speed is appropriately reduced.

As is well known, the crystal structure of the snow is similar to a pyramidal structure. The arrangement of the large, middle, small balls 304, 304a, 305 forms the linked pyramidal structure so that the player can feel as if he slid on the natural snow slope.

Figs. 8 to 10 are views illustrating the pyramidal structures respectively selected from those illustrated in Fig. 6. Fig. 8 shows a regular pyramidal structure in which the small balls 305 are arranged around the middle balls 304a. Figs. 9 and 10 show reversed pyramidal structures in which the large balls 304 are arranged around the middle balls 304a.

### Fourth Embodiment (Figs. 11 to 14):

The sliding device according to a fourth embodiment will be described with reference to Figs. 11 to 14.

A substrate 402 has recesses 406, 407 in which large and middle balls 404, 405 are rotatably engaged. The recesses 406, 407 are arranged regularly, vertically, laterally and aslant at the angle of  $45^\circ$ . The arrangement of the large and the small balls 404, 405 are illustrated in Fig. 11 in which the large balls 404 intervene the middle balls 405 therebetween and arranged alternately. More in detail, the pyramidal structure is illustrated in Fig. 13 in which four middle balls 405 are arranged around one large ball 404. Another pyramidal structure is illustrated in Fig. 14 in which eight middle balls 405 are arranged around one large ball. When the player slides on the artificial ski slope having the arrangement according to the fourth embodiment, the ski is placed and slides on the large balls 404 in making the schussing. However, if the player turns the ski and make the traversing, then the ski is often placed on the middle balls 405 for thereby subjecting the ski to the various changes.

### Fifth Embodiment (Figs. 15 to 18):

The sliding device according to a fifth embodiment will be described with reference to Figs. 15 to 18.

A ski has a sliding device according to the fifth embodiment comprises a ski 501 and a plurality of large and middle balls 502, 503 provided at the lower portion thereof. The ski 501 has a wooden body 504 constituting a main portion thereof, a holding substrate 505 and a liner 506, the holding substrate 505 and the liner 506 are respectively adhered to the lower surface of the wooden body 504 for holding large and middle balls 502, 503.

The holding substrate 505 made of rigid plastics has recessed hemispherically at the lower portion thereof for forming recesses 510, 511 in which the large and the middle balls 502, 503 are engaged. The spherical recesses 510, 511 are arranged vertically, laterally and aslant at the angle of  $45^\circ$ . The arrangement of the large and the middle

balls 502, 503 is illustrated in Fig. 16 in which the large balls 502 are alternately arranged vertically, laterally and aslant.

In the case that the sliding device is employed in the skate board, the sliding surface may be the one set forth above or a plate made of rigid plastic or covered by a wooden plate, or a concrete.

#### Sixth Embodiment (Figs. 18 to 21):

A sliding device according to a sixth embodiment will be described with reference to Figs. 18 to 21.

The sliding device comprises a descending plate P having a gentle inclination of the angle 5 to 30° provided under a play area 601, free balls 603, large and small restricting balls 604, 605 arranged respectively on the sliding plate P and an ascending plate 606 through which the player He who completed the descending practice returns to the play area 601. The descending plate P comprises a substrate 608 and an upper sheet 609 adhered to the substrate 608 and elevated gradually at the both sides thereof 615, 615 for forming curved portions, a hill portion 616 at the central portion thereof and guiding paths 617, 617 positioned between the hill portion 616 and the elevated both sides 615, 615 for guiding the player separately at right and left sides of the hill portion 616.

The hill portion 616 has a play spot provided with no balls at the lower portion thereof on which the player can get. The substrate 608 made of rigid plastics has recesses 610 regularly vertically and laterally for receiving the free balls 603 as illustrated in Fig. 19 and large and small ejecting holes 611, 612 alternately arranged between the recesses 610, 610 for receiving large and small restricting balls. Bearing portions 614 are provided between the large and the small ejecting holes 611, 612. The large ejecting holes 611 are arranged at the middle portion between the free balls 603, 603 while the small ejecting holes 612 are arranged on the same line as the small balls 603.

The large and the small restricting balls 604, 605 are supported relative to the large and the small ejecting holes 611, 612 in the manner that grooves 622 are defined on the substrate 608 for receiving shafts 621 each made of a stainless steel and the projections 623 are provided on the upper sheet 609 for pressing and fixing the shafts 621. The shafts 621 are bent at the curved portions 615, 615 of the descending plate P but straight at the portion through which the large and the small restricting balls 604, 605 insert.

The upper sheet 609 made of rigid or semi-rigid plastics is provided with spherical projecting edges 627, 628, 629 corresponding to the recesses

610, the large and the small ejecting holes 611, 612 diameter of which are defined smaller than those of the balls 603, 604, 605 whereby the free balls 3 are prevented from getting out relative to the spherical projecting edges 617. The free balls 603 have same diameters as the large restricting balls 604 and the small restricting balls have diameters less than those of 603, 604. Inasmuch as the free balls 603 having the height from the substrate higher than that of the small restricting balls 605, 605 are arranged between the upper and the lower small restricting balls 605, so that the turning of the ski can be made by the free balls 603.

With the arrangement of the sliding device according to the first to fourth embodiments, there are following first advantage.

Inasmuch as the plurality of balls are rotatably arranged on the sliding surface of the slope, the player can descend on the slope while the balls are rotated. Generated between the ski and the balls is the rolling friction which produces less frictional heat whereby the ski is not likely to be damaged and the accelerating distance is reduced for thereby obtaining high speed from the beginning of descending action. Even if the descending speed is increased, the ski is not stemmed. Furthermore, the player can enjoy the ski since there is unevenness due to the balls on the slope as if they descended on the natural ski slope.

In addition to the first advantage set forth just above, there is a second advantage according to the second embodiment. That is, at the time of traversing of the ski, the balls having small diameters receive the ski in the auxiliary manner so that the player can enjoy smooth sliding on the slope whereby there is an advantage that the ski can be turned with ease from the schussing to the traversing and vice versa as if it were made on the natural snow slope.

In addition to the first advantage, there is a third advantage according to the third embodiment. That is, inasmuch as the ski can slide mainly on the large balls and the middle and the small balls are structured to resist to the ski sliding to some extent, the sliding speed can be restricted. Furthermore, inasmuch as the large and the middle balls can be formed in the pyramidal arrangement similar to the snow crystal in the artificial ski slope, the player can feel as if he were sliding on the natural snow slope.

In addition to the first advantage, there is a fourth advantage according to the fourth embodiment. That is, inasmuch as the structure of the balls can be formed in the semi-pyramidal structure, namely, the middle balls are arranged around the large balls in the manner that the height of each middle ball exposed from the substrate is less than that of each large ball which serves as the apex so



that the artificial ski slope can be structured as if the player felt the sliding on the natural snow slope.

There is a fifth advantage according to the fifth embodiment. That is, since the balls comprises large and middle ones which are arranged appropriately and differentiated in the height thereof from the substrate, the large balls mainly contact the slope for carrying out sliding and the middle balls contact the slope in the auxiliary manner in the case that the ski etc. receive the shock or are turned to the different direction so that the player can enjoy the peculiar feeling. Furthermore, the structure of the artificial slope is simple for thereby involving low cost in the installation thereof and the maintenance thereof. Still furthermore, the stability, free sliding direction, and high cushion can be obtained in any of the ski, the sleigh and the skate board so that the player can comfortably enjoy the sliding.

There is a sixth advantage according to the sixth embodiment. That is, since the ski and the like can slide on the slope by the rotation of the balls, it is possible to obtain the descending speed even on the gentle slope and prevent the end of the wear from being caught in the rollers with the rotation of the balls to assure the safe sliding. Furthermore, since the balls have no cornered portions the player can make a comfortable sliding without vibrating laterally. The player can freely turn because of the free balls and the slope is designable to have curved portions in the width direction without cornering at the curved portions.

Although the invention has been described in its preferred form with a certain degree of particularity, it is to be understood that many variations and changes are possible in the invention without departing from the scope thereof.

The features disclosed in the foregoing description, in the claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

## Claims

### 1. A sliding device comprising:

a descending sheet (S) mounted on a descending slope (1) and having a descending substrate (2);  
a plurality of recesses (5) arranged uniformly on the substrate (2);  
a plurality of balls (4) engaged in the recesses (5) for supporting the ski and rotatable in full directions, the plurality of balls (4) being exposed over the substrate (2) so that the ski contacts the balls (4); and  
projecting edges (12) provided at peripheries of the

recesses (5) on the substrate (2) for preventing the plurality of balls (4) from getting out from the recesses (5).

### 2. A sliding device comprising:

a sheet (S) mounted on a slope and having a substrate (202);  
a plurality of large recesses (206) arranged uniformly on the substrate (202);  
a plurality of small recesses (207) arranged over and lower, left and right of the large recesses (206);  
a plurality of balls (204) each having large diameter engaged in the large recesses (206) and rotatable in full directions; and  
a plurality of balls (205) each having small diameter and engaged in the small recesses (207) and rotatable in full directions in the manner that the height of each ball (205) having small diameter exposed from the substrate (202) is lower than that of each ball (204) having large diameter so that the balls (205) having small diameter can receive the ski in an auxiliary manner.

### 3. A sliding device comprising:

a sheet (S) mounted on a slope and having a substrate (302);  
a plurality of large and middle recesses (306, 306a) arranged uniformly on the substrate (302);  
a plurality of small recesses (307) arranged over and lower, right and left of the large and the middle recesses (306, 306a); and  
a plurality of balls (304, 304a, 305) each having large, middle, small diameters rotatably engaged in full directions in the plurality of large, middle, small recesses (306, 306a, 307) wherein the balls (304) having large diameter serve to assist the ski descending while the balls (304a, 305) having the middle and the small diameters serve to resist against the ski descending.

### 4. A sliding device comprising:

a sheet (S) mounted on a slope and having a substrate (402);  
a plurality of large and middle recesses (406, 407) arranged uniformly on the substrate in the manner that the middle recesses (407) are arranged around the large recesses (406); and  
a plurality of balls (404, 405) each having large, middle diameters rotatably engaged in the plurality of large, middle recesses (406, 407) for forming pyramidal structure in the manner that the height of each ball (405) having middle diameter exposed from the substrate (402) is lower than that of each ball (404) having large diameter serving as an apex.

### 5. A sliding device for use in a ski, a sleigh, a skate board comprising:

a body (504);  
a substrate (505) fixedly layed on the body (504); and

a plurality of large and middle recesses (510, 511) provided at the substrate (505) in such arrangement that the middle recesses (511) are arranged around the large recesses (510); and

a plurality of large balls (502) and middle balls (503) respectively rotatably engaged in the large and middle recesses (510, 511) and exposed over the substrate (505) in the manner that the height of each large and middle ball (502, 503) exposed from the substrate (505) are differentiated.

6. A sliding device comprising:

a slope (P) having the sliding surface (609) thereon;

a plurality of recesses (610) formed on the slope (P);

a shaft (621) provided at the slope (P);

a plurality of free balls (603) rotatably engaged in the recesses (610); and

restricting balls (604, 605) rotatably supported by the shaft (621) in the descending direction.

5

10

15

20

25

30

35

40

45

50

55

8

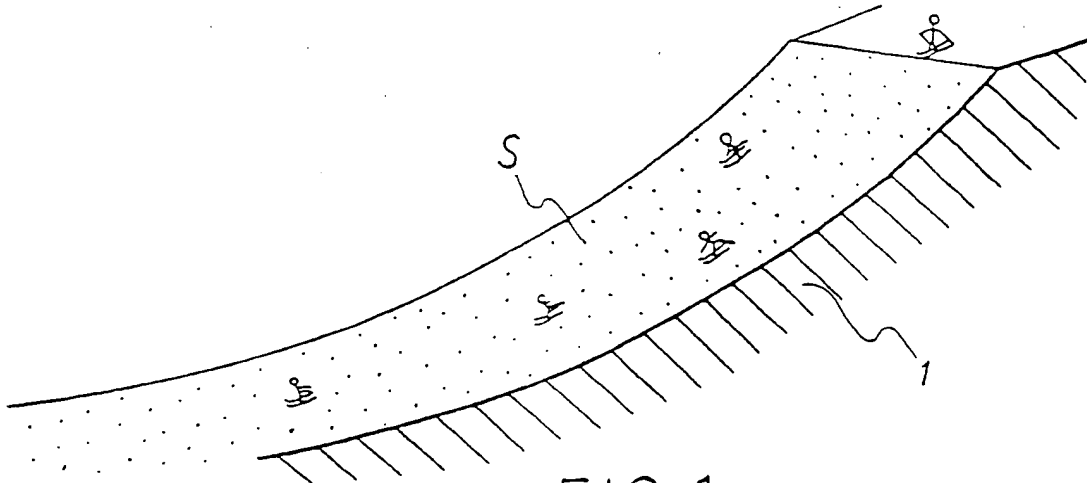


FIG 1

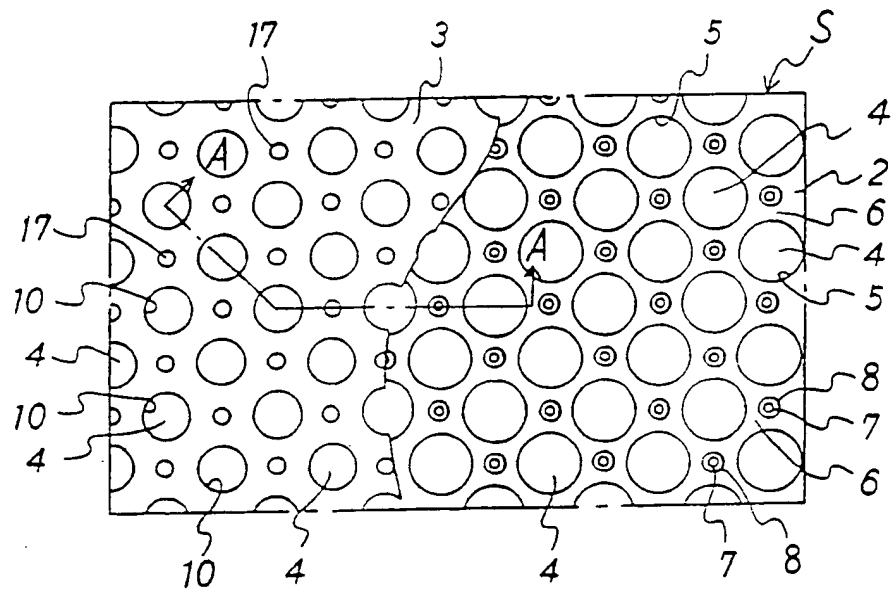


FIG 2

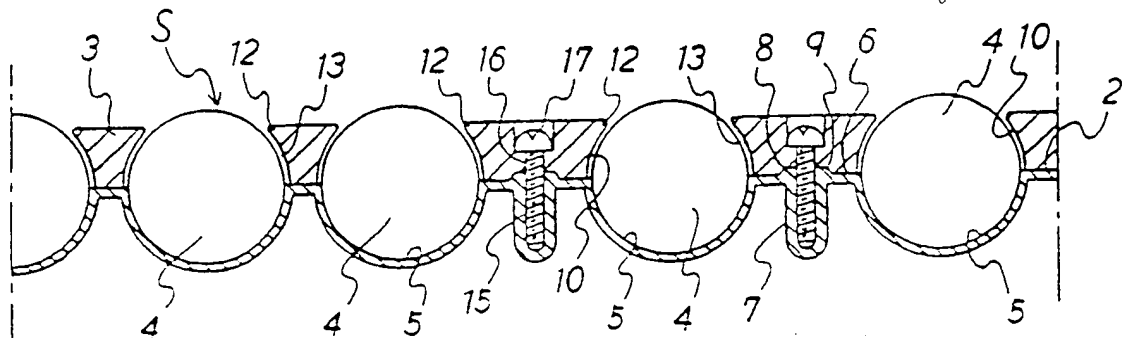


FIG 3

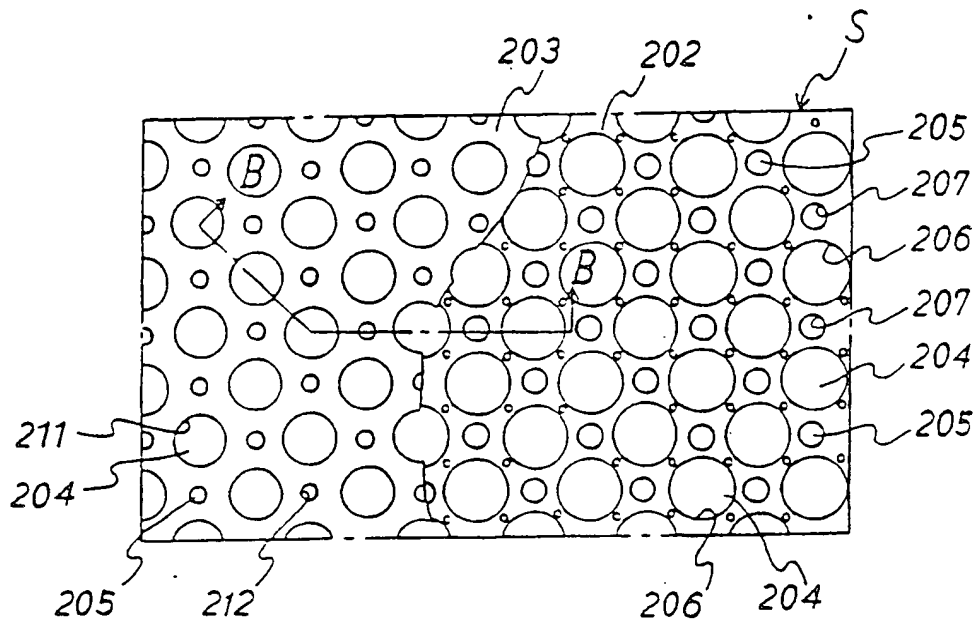


FIG 4

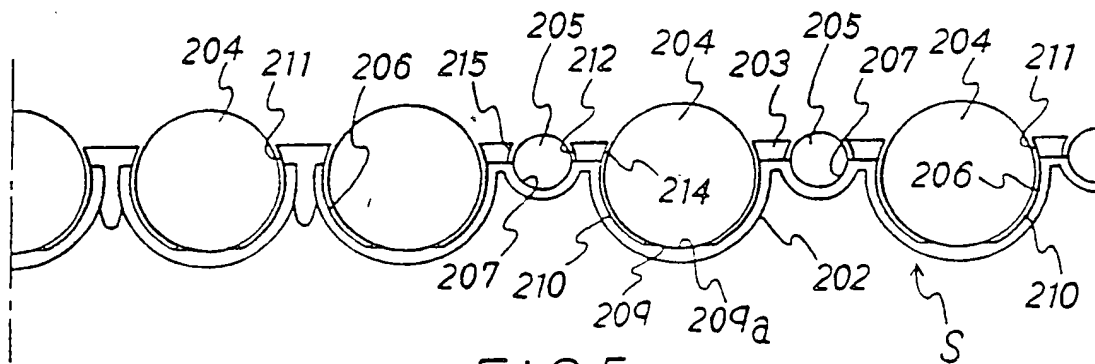


FIG 5

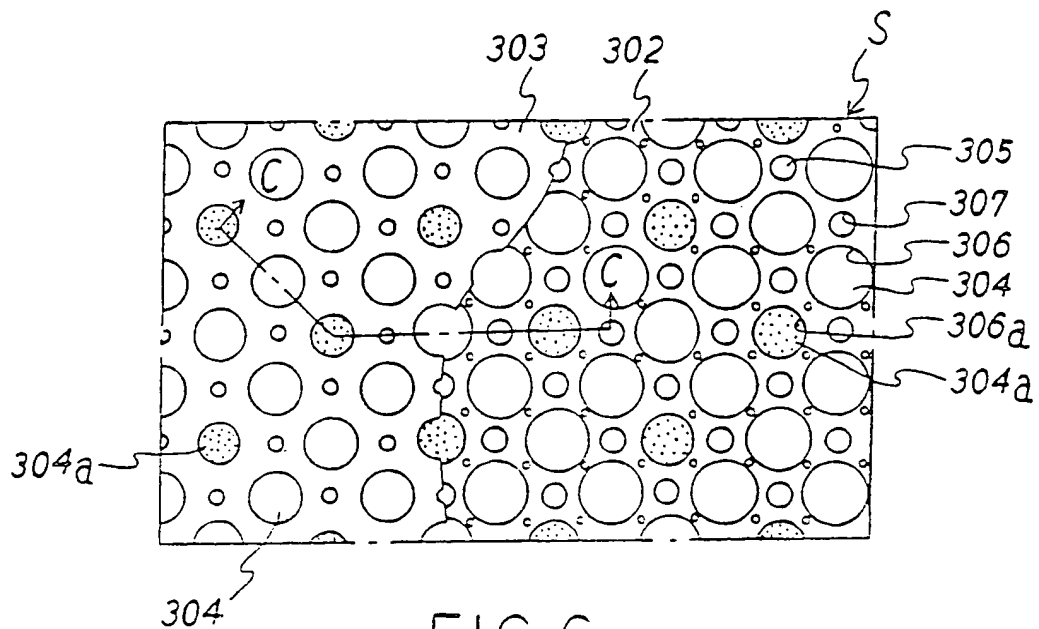


FIG 6

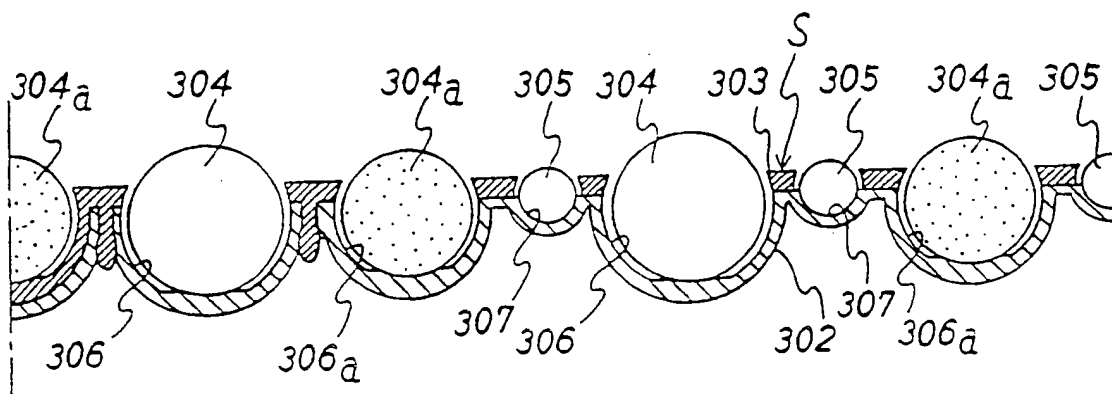


FIG 7

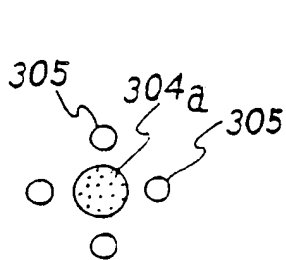


FIG 8

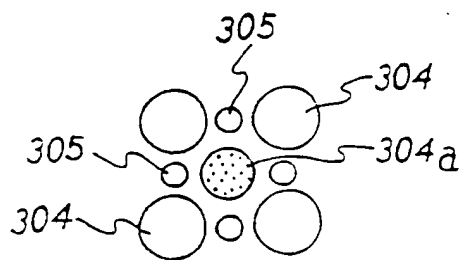


FIG 9

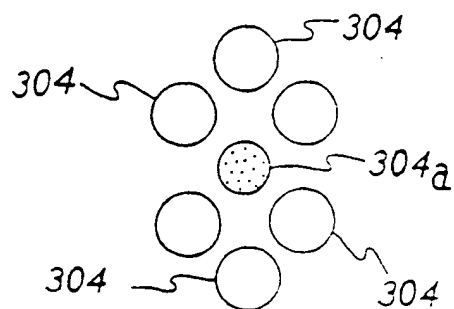


FIG 10

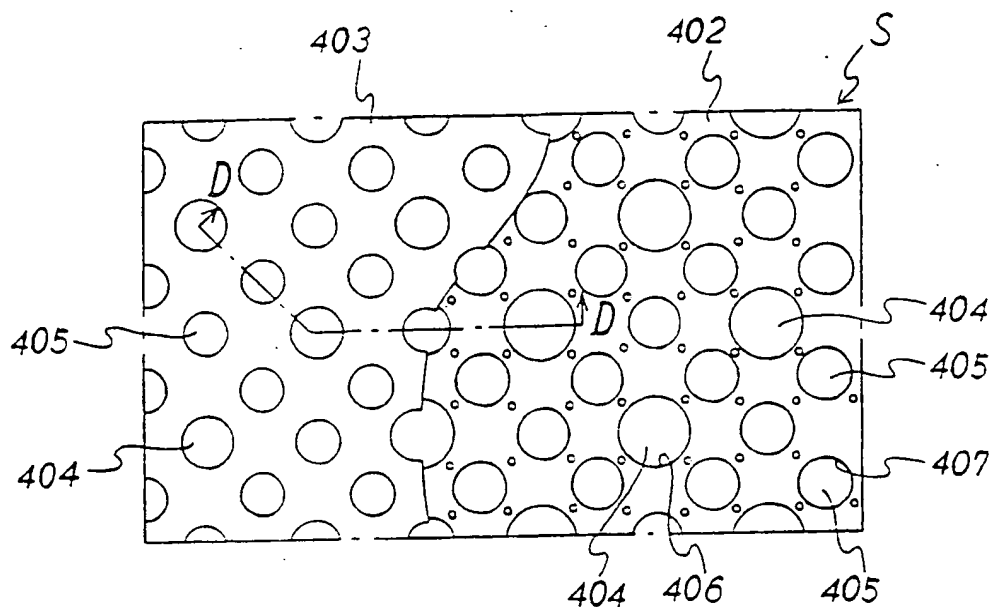


FIG 11

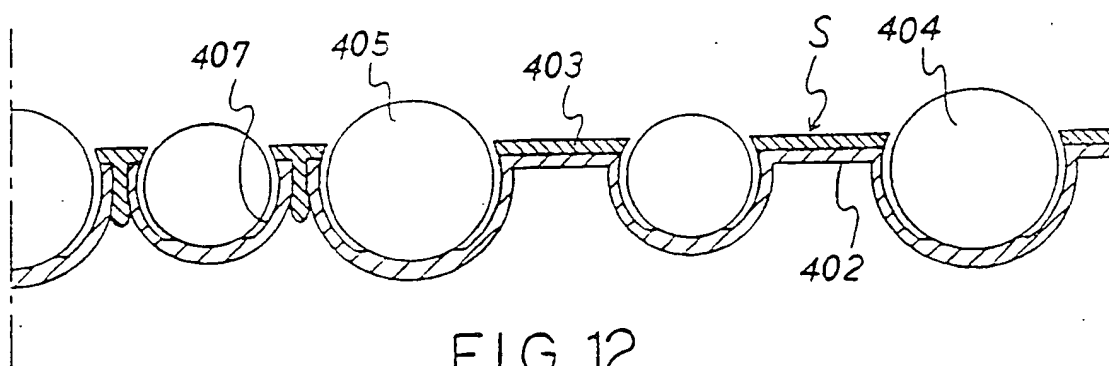


FIG 12

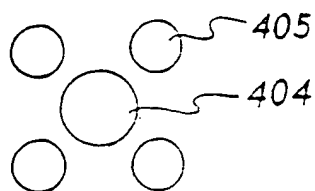


FIG 13

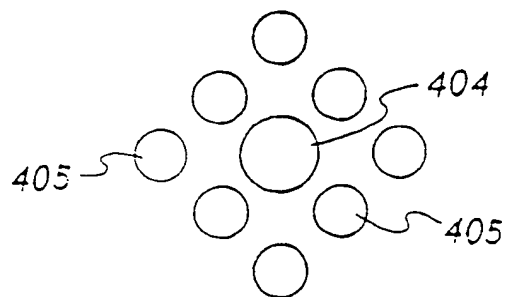


FIG 14

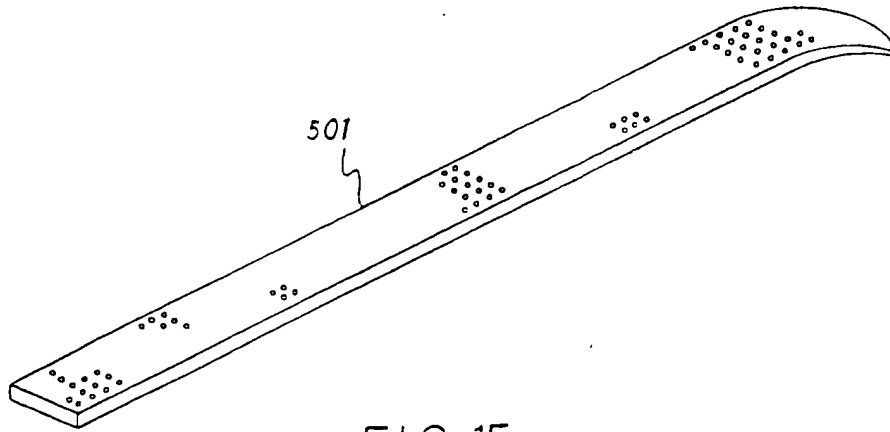


FIG 15

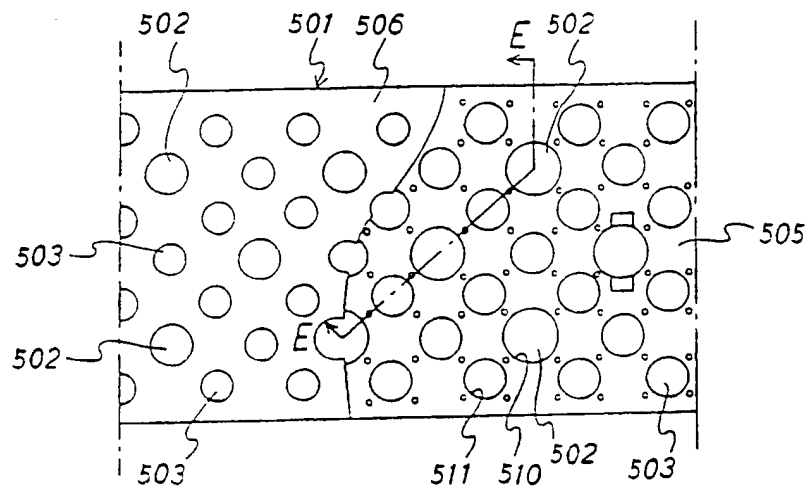


FIG 16

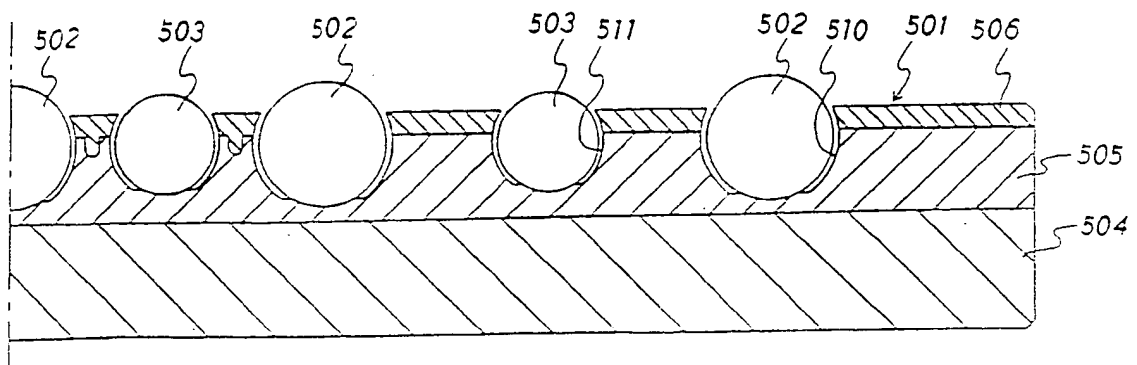


FIG 17

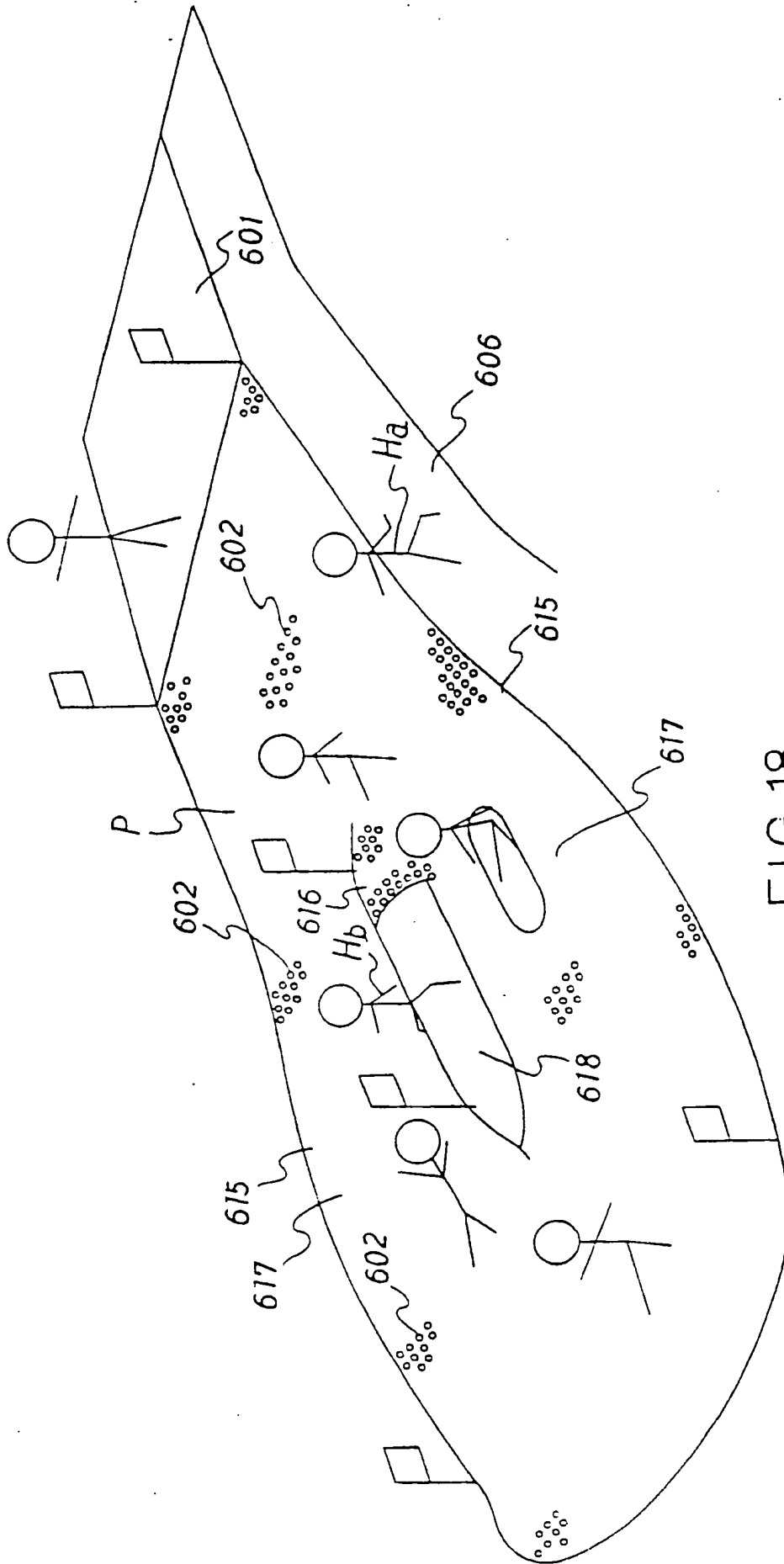


FIG 18



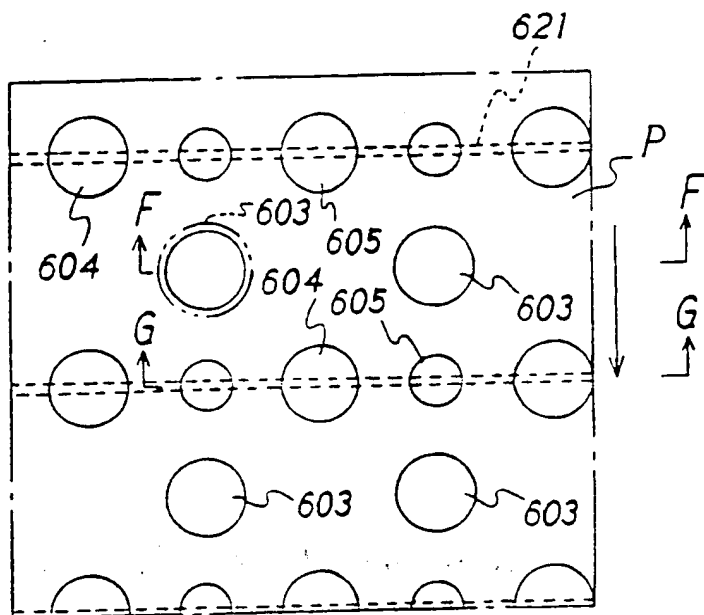


FIG 19

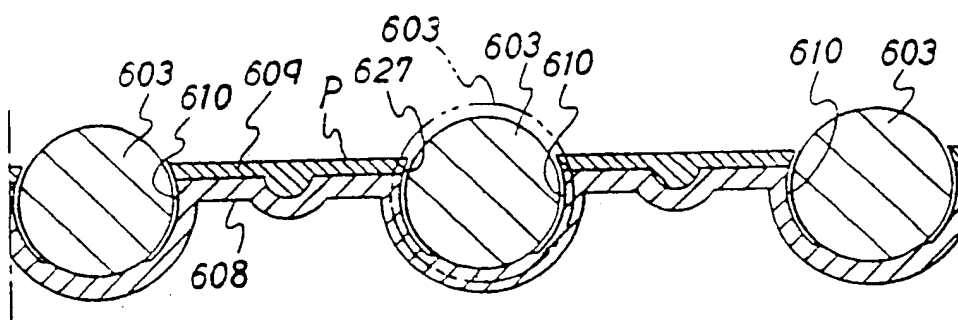


FIG 20

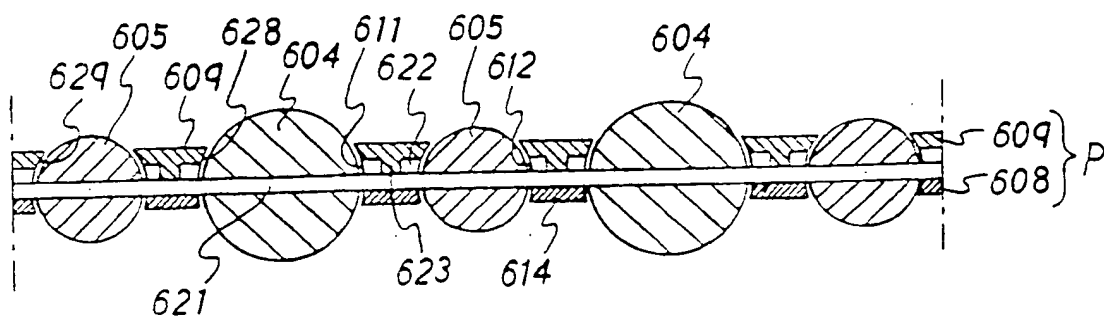


FIG 21

**THIS PAGE BLANK (USPTO)**



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11) Publication number:

**0 384 383 A3**

(12)

## EUROPEAN PATENT APPLICATION

(21) Application number: 90103213.6

(51) Int. Cl.<sup>5</sup>: **A63C 5/035, A63C 17/04, A63C 19/10, E01C 13/00**

(22) Date of filing: 20.02.90

(30) Priority: 20.02.89 JP 39719/89  
15.05.89 JP 120838/89  
19.06.89 JP 156138/89  
23.08.89 JP 216270/89  
25.08.89 JP 219598/89  
23.10.89 JP 275362/89

(43) Date of publication of application:  
29.08.90 Bulletin 90/35

(84) Designated Contracting States:  
**CH DE ES FR GB IT LI NL SE**

(88) Date of deferred publication of the search report:  
04.09.91 Bulletin 91/36

(71) Applicant: Nagahisa, Kouichi  
2-37, Ekinan 4-chome  
Takaoka-shi, Toyama-ken 933(JP)

(72) Inventor: Nagahisa, Kouichi  
2-37, Ekinan 4-chome  
Takaoka-shi, Toyama-ken 933(JP)

(74) Representative: Goddar, Heinz J., Dr. et al  
**FORRESTER & BOEHMERT**  
Widenmayerstrasse 4/I  
W-8000 München 22(DE)

(54) Sliding device.

(57) There are disclosed several sliding devices. One sliding device comprises a sheet (S) mounted on a slope (1) and having a descending substrate (2), a plurality of recesses (5) arranged uniformly on the substrate (2), a plurality of balls (4) engaged in the recesses (5) for supporting the ski and rotatable in

full directions, the plurality of balls (4) being exposed over the substrate (2) so that the ski contact the balls (4), and projecting edges (12) provided at peripheries of the recesses (5) on the substrate (2) for preventing the plurality of balls (4) from getting out from the recesses (5).

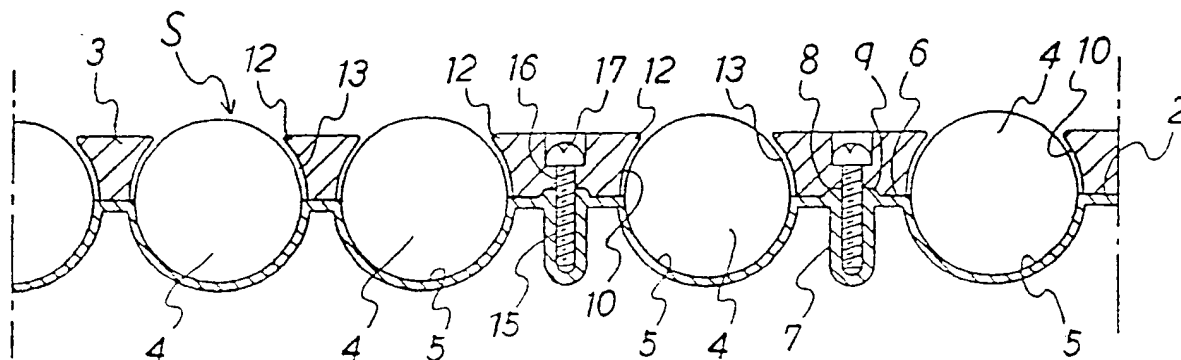


FIG 3



European  
Patent Office

# EUROPEAN SEARCH REPORT

Application Number

EP 90 10 3213

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-3 522 951 (TYSON) * claims 1, 2; figures 1-4, 6 * - - - -	1-6	A 63 C 5/035 A 63 C 17/04 A 63 C 19/10 E 01 C 13/00
A	AT-B-1 497 05 (RAFFLOER) * page 1, lines 1 - 20 * - - - -	1-6	
A	GB-A-2 038 644 (WINSTANLEY) * claims 1-6; figures 1-6 * - - - -	1-6	
A	EP-A-0 232 065 (BALL TREK CORP.) * claim 1; figures 2a, 5, 6 * - - - -	1-6	
A	Soviet Inventions Illustrated, Derwent Publications Ltd, Section Mechanical, week C16, abstract no.28614, A86, 28 May 1980 & SU - A - 679215 (KRUGLOV), 19.12.1977 - - - -	6	
A	FR-A-1 418 835 (SEE) * claim 1; figures 4-7 * - - - -	6	
A	US-A-3 422 732 (YORK) * claim 1; figures 1-3, 5 * - - - -	6	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	AT-B-3 300 43 (MAJAREK ET AL.) * claims 1, 2; figures 1-4 * - - - - -	1-6	A 63 C E 01 C
The present search report has been drawn up for all claims			
Place of search Berlin		Date of completion of search 05 July 91	Examiner MICHELS N.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention</p> <p>E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			